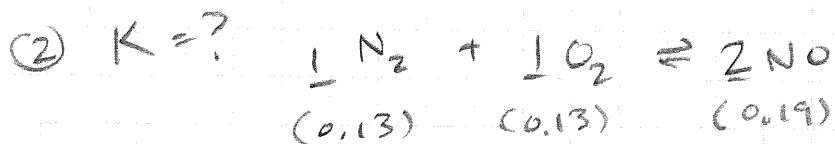


$$K = \frac{[\text{HCl}]^2}{[\text{H}_2][\text{Cl}_2]}$$

$$K = \frac{(0.95)^2}{(0.075)(0.075)} = \frac{0.903}{5.63 \times 10^{-3}} = 1.60 \times 10^2$$

$$\boxed{K = 160}$$



$$K = \frac{[\text{NO}]^2}{[\text{N}_2][\text{O}_2]} = \frac{(0.19)^2}{(0.13)^2} = \frac{3.61 \times 10^{-2}}{1.69 \times 10^{-2}} = 2.14$$

$$\boxed{K = 2.14}$$



$$K = \frac{[\text{HI}]^2}{[\text{H}_2][\text{I}_2]} = 54.3 = \frac{(2x)^2}{(0.750-x)^2} \Rightarrow 7.37 = \frac{2x}{0.75-x}$$

$$K = (7.37)(0.75-x) = 2x$$

$$(5.53)(-7.37x) = 2x$$

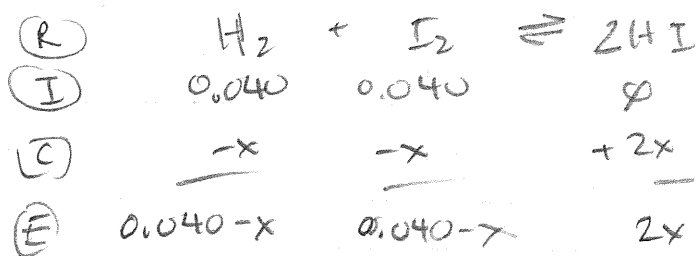
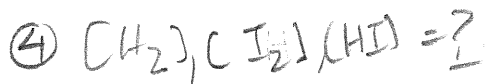
$$+7.37x \quad +7.37x$$

$$5.53 = 9.37x$$

$$\boxed{0.590 = x}$$

$$\left. \begin{array}{l} \text{H}_2 = 0.750 - 0.590 = 0.160 \text{ M} \\ \text{I}_2 = \longrightarrow 0.160 \text{ M} \end{array} \right\}$$

$$\left. \begin{array}{l} \text{HI} = 2(0.590) = 1.18 \text{ M} \end{array} \right\}$$



$$K = \frac{[HI]^2}{[H_2][I_2]} = 54.3 = \frac{(2x)^2}{(0.040-x)(0.040-x)}$$

$$7.369 = \frac{2x}{0.040-x} = (7.369)(0.040-x) = 2x$$

$$\begin{array}{r} 0.295 - 7.369x = 2x \\ \hline + 7.369x \quad + 7.369x \end{array}$$

$$\begin{array}{r} 0.295 = 9.369x \\ \hline 3.146 \times 10^{-2} = x \end{array}$$

$$\begin{aligned} [H_2] &= (4.0 \times 10^{-2}) - (3.146 \times 10^{-2}) = 8.54 \times 10^{-3} \text{ M} \\ [I_2] &= \text{---} \rightarrow 8.54 \times 10^{-3} \text{ M} \\ [HI] &= 2(3.146 \times 10^{-2}) = \text{---} \rightarrow 6.31 \times 10^{-2} \text{ M} \end{aligned}$$

⑤ $[SO_2]$? $[NO_2]$? $[NO]$? $[SO_3]$?



$$\textcircled{I} = 0.025 \quad 0.025 \quad 0.025 \quad 0.025$$

$$\textcircled{C} = -x \quad -x \quad +x \quad +x$$

$$\textcircled{E} = 0.025-x \quad 0.025-x \quad 0.025+x \quad 0.025+x$$

$$K_c = \frac{[NO][SO_3]}{[SO_2][NO_2]} = 85.0 = \frac{(0.025+x)^2}{(0.025-x)^2}$$

$$9.22 = \frac{0.025+x}{0.025-x}$$

$$(9.22)(0.025-x) = 0.025+x$$

$$(0.231) - (9.22x) = 0.025+x$$

$$+ 9.22x \quad + 9.22x$$

$$0.231 = 0.025 + 10.22x$$

$$\underline{-0.025} \quad \underline{-0.025}$$

$$0.206 = 10.22x$$

$$2.016 \times 10^{-2} = x$$

$$[SO_2] = (2.5 \times 10^{-2}) - (2.02 \times 10^{-2}) = 4.80 \times 10^{-3} \text{ M}$$

$$[NO_2] = \longrightarrow 4.8 \times 10^{-3} \text{ M}$$

$$[NO] = (2.5 \times 10^{-2}) + (2.02 \times 10^{-2}) = 4.52 \times 10^{-2} \text{ M}$$

$$[SO_3] = \longrightarrow 4.52 \times 10^{-2} \text{ M}$$

$$b) [N_2], [O_2], [NO] = ?$$

$$K = 85.0$$

concentrations:

$$\frac{0.185 \text{ mol}}{6 \text{ L}} = 3.08 \times 10^{-2} = [O_2]_0 = [NO]_0$$



$$I) \quad 3.08 \times 10^{-2} \qquad 3.08 \times 10^{-2} \qquad 3.08 \times 10^{-2}$$

$$C) \quad -2x \qquad +x \qquad +x$$

$$E) \quad 3.08 \times 10^{-2} - 2x \qquad 3.08 \times 10^{-2} + x \qquad 3.08 \times 10^{-2} + x$$

$$K = \frac{[N_2][O_2]}{[NO]^2} = 85.0 = \frac{(3.08 \times 10^{-2} + x)^2}{(3.08 \times 10^{-2} - x)^2} \Rightarrow 9.22 = \frac{3.08 \times 10^{-2} + x}{3.08 \times 10^{-2} - x}$$

$$K = (9.22)(3.08 \times 10^{-2} - x) = 3.08 \times 10^{-2} + x$$

$$K = (2.84 \times 10^{-1}) - (9.22x) = 3.08 \times 10^{-2} + x$$

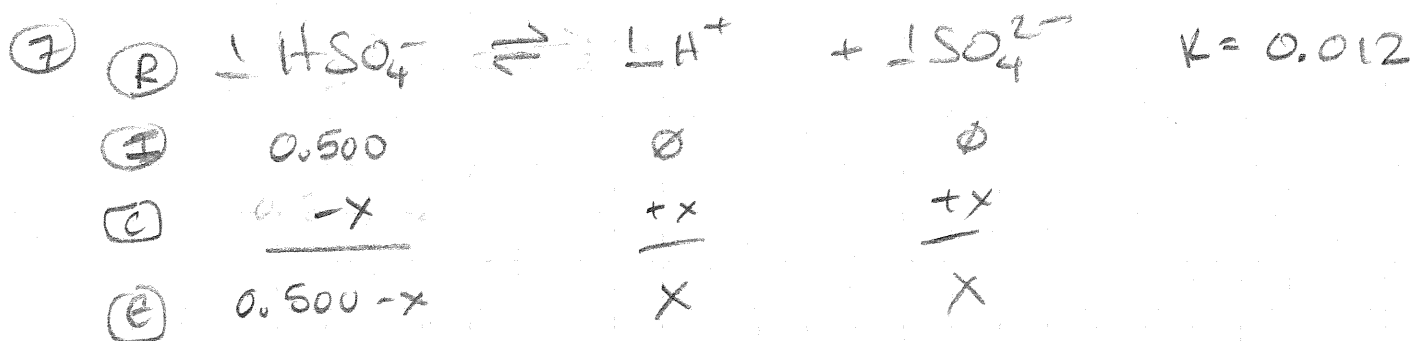
$$-3.08 \times 10^{-2} \quad + 9.22x \quad -3.08 \times 10^{-2} + 9.22x$$

$$K = 2.53 \times 10^{-1} = 10.22x$$

$$2.48 \times 10^{-2} = x$$

$$[NO] = (2)(2.48 \times 10^{-2}) \longrightarrow = 4.96 \text{ M}$$

$$[N_2] = [O_2] = (3.08 \times 10^{-2}) - (2.48 \times 10^{-2}) = 6.00 \times 10^{-3} \text{ M}$$



$$K = \frac{[\text{H}^+][\text{SO}_4^{2-}]}{[\text{HSO}_4^-]} = 0.012 = \frac{(x)(x)}{0.500 - x}$$

$$0.012 = \frac{x^2}{0.500 - x}$$

- (1) You can solve this using the quadratic equation
 (2) or you solve it by using the "5% rule".

Reasoning: Because K is small, we can assume 5% rule that the amount lost (" $-x$ ") is small compared with [reactant]. In other words:

$$0.500 - x \approx 0.500$$

Therefore: $0.012 = \frac{x^2}{0.500}$

$$0.024 = x^2$$

$$7.75 \times 10^{-2} = x$$

$[\text{HSO}_4^-] = 0.500 - 7.55 \times 10^{-2} = 0.423 \text{ M}$
 $[\text{H}^+] = x \longrightarrow = 7.55 \times 10^{-2} \text{ M}$
 $[\text{SO}_4^{2-}] = x \longrightarrow = 7.55 \times 10^{-2} \text{ M}$

* 5% rule: when $\frac{x}{[\text{reactants}]} < 5\%$, $[\text{reactant}] - x \approx [\text{reactant}]$

(5% rule works b/c measurement are generally $\pm 5\%$ for concnts)